

# Digital Engineering

---

Digital Engineering

The printable version is no longer supported and may have rendering errors. Please update your browser bookmarks and please use the default browser print function instead.

---

**Lead Author:** *Ron Giachetti*

---

The US Under Secretary of Defense for Research and Development released the US Department of Defense (DoD) Digital Engineering Strategy in June 2018 describing five goals to streamline the DoD acquisition process through the creation of a digital thread enabling the conception, design, and development of complex weapon systems (DoD 2018; Zimmerman 2017). The crux of digital engineering is the creation of computer readable models to represent all aspects of the system and to support all the activities for the design, development, manufacture, and operation of the system throughout its lifecycle. These computer models would have to be based on shared data schemata so that in effect a digital thread integrates all the diverse stakeholders involved in the acquisition of new weapon systems. The Digital Engineering Strategy anticipates digital engineering will lead to greater efficiency and improved quality of all the acquisition activities.

## Contents

---

Relationship with MBSE

Digital Engineering as a Transformation

Digital Twin

References

    Works Cited

    Primary References

    Additional References

    Relevant Videos

## **Relationship with MBSE**

---

Model-based systems engineering (MBSE) is a subset of digital engineering. MBSE supports the systems engineering activities of requirements, architecture, design, verification, and validation. These models would have to be connected to the physics-based models used by other engineering disciplines such as mechanical and electrical engineering. One challenge remaining for digital engineering is the integration of MBSE with physics-based models.

Foundation to digital engineering is the representation of the system data in a format sharable between all stakeholders (Giachetti et al. 2015; Vaneman 2018). SysML 2.0 is one of several future developments promising to provide a representation sufficient to support digital engineering. An ontology defining the entities and relationships between them can be used to define the concepts relevant to systems engineering. Such a representation is necessary to create the digital thread linking all the models together in a cohesive and useful manner.

## **Digital Engineering as a Transformation**

---

For many organizations, digital engineering represents a transformation of how they normally conduct systems engineering (e.g., see Bone et al. 2018) since most organizations conduct a document-intensive systems engineering process. The adoption of digital engineering requires concomitant changes to how organizations perform system engineering activities. Everything from documenting requirements, technical reviews, architecture design, and so forth would be based on the models in a digital engineering environment (Vaneman and Carlson, 2019). The digital thread would be the authoritative source of truth concerning the system data.

## **Digital Twin**

---

A digital twin is a related yet distinct concept to digital engineering. The digital twin is a high-fidelity model of the system which can be used to emulate the actual system. An organization would be able to use a digital twin to analyze design changes prior to incorporating them into the actual system.

# References

---

## Works Cited

Bone, M.A., M.R. Blackburn, D.H. Rhodes, D.N. Cohen, and J.A. Guerrero. 2018. "Transforming systems engineering through digital engineering," *The Journal of Defense Modeling and Simulation* (2018): 1548512917751873.

DoD. 2018. *DoD Digital Engineering Strategy*. Washington, D.C., USA: Office of the Undersecretary of Defense for Research and Engineering (OUSD R&E), US Department of Defense.

Giachetti, R.E. 2015. "Evaluation of the DoDAF meta-model's support of systems engineering," *Procedia Computer Science*, vol. 61, pp. 254-260.

Vaneman, W.K. 2018. "Evolving model-based systems engineering ontologies and structures," Proceedings of the International Council on Systems Engineering (INCOSE) International Symposium, Washington D.C., USA, July 7-12, 2018. Symposium Proceedings vol. 28, no. 1, pp. 1027-1036.

Zimmerman, P. "DoD digital engineering strategy," Proceedings of the 20th Annual National Defense Industrial Association (NDIA) Systems Engineering Conference, Springfield, VA, October 23-26, 2017.

## Primary References

Bone, M.A., M.R. Blackburn, D.H. Rhodes, D.N. Cohen, and J.A. Guerrero. 2018 "Transforming systems engineering through digital engineering," *The Journal of Defense Modeling and Simulation* (2018): 1548512917751873.

Singh, V. and K.E. Willcox. "Engineering design with digital thread," *AIAA Journal*, vol. 56, no. 11, pp. 4515-4528.

Zimmerman, P. "DoD digital engineering strategy," Proceedings of the 20th Annual National Defense Industrial Association (NDIA) Systems Engineering Conference, Springfield, VA, October 23-26, 2017. OUSD R&E, DoD Digital Engineering Strategy, (June 2018).

## Additional References

None.

## Relevant Videos

- Digital Engineering: MBSE Approach for DoD

---

< Previous Article | Parent Article | Next Article >

**SEBoK v. 2.4, released 19 May 2021**

---

Retrieved from

"[https://sandbox.sebokwiki.org/index.php?title=Digital\\_Engineering&oldid=61646](https://sandbox.sebokwiki.org/index.php?title=Digital_Engineering&oldid=61646)"

---

**This page was last edited on 19 May 2021, at 01:27.**